

REMARKS

Claims 1-3 and 5-49 are pending in the application. Claim 1 is currently amended. Claim 4 has been cancelled. Claims 15-26 have been withdrawn from consideration. Applicant respectfully requests for allowance of all the pending claims based on following discussions.

Rejections under 35 USC 102

Claims 1, 2, 6-9, 13, 14, 27, 28, 35, 37, 41 and 42 are rejected under 35 USC 102(b) as being anticipated by US Patent No. 6,355,151 to Brosda et al. (hereinafter referred to as "Brosda").

Claim 1

A. The sensor of the claimed invention operates in adsorption and titration phases, alternately.

Independent claim 1 is directed to an organic contaminant molecule sensor for use in a process environment having a low oxygen concentration. With reference to FIG 1 showing an embodiment of the claimed invention, the sensor comprises an electrochemical cell (13) comprising: a solid state oxygen anion conductor (12) in which oxygen anion conduction occurs at or above a critical temperature; a measurement electrode (10) formed on a first surface of the anion conductor for exposure to the monitored environment (14), the measurement electrode (10) comprising a material for catalyzing the dehydrogenation of an organic contaminant molecule wherein at temperatures below the critical temperature, organic contaminant molecules are adsorbed onto and dehydrogenated at the surface of the material of the measurement electrode (10)

to form a carbonaceous deposit on the surface of the material of the measurement

electrode; and a reference electrode (16) formed on a second surface of the anion

conductor (12) for exposure to a reference environment (18), the reference electrode (16)

comprising a material for catalyzing the dissociation of oxygen to oxygen anions; a

heater (24) for controlling the temperature of the electrochemical cell in a manner that the

heater (24) sets a temperature of the solid state oxygen anion conductor (12) below the

critical temperature during an adsorption phase, and at or above the critical temperature

during a titration phase (*the underlined text being the currently added limitations*); and a

current source (28) for controlling the electrical current between the reference electrode

(16) and the measurement electrode (10) wherein at temperatures above the critical

temperature, an electrical current is passed between the reference electrode (16) and the

measurement electrode (10) to control the number of oxygen anions passing from the

reference electrode (16) to the measurement electrode (10) to oxidize the carbonaceous

deposit.

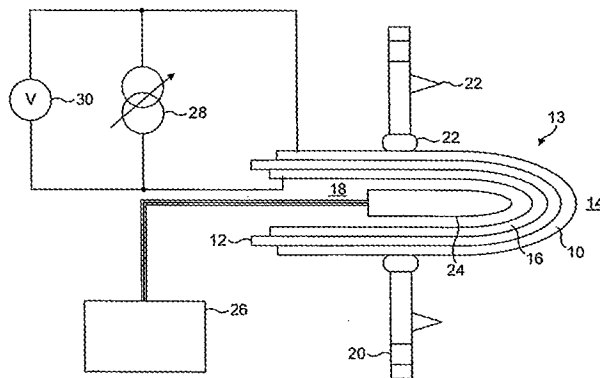


FIG. 1

The sensor of the claimed invention measures the concentration of organic contaminant molecules by switching between adsorption and titration phases. In the

adsorption phase, the heater (24) sets the temperature of the solid state oxygen anion conductor (12) below the critical temperature, such that the conductor would not conduct oxygen anions from the reference electrode (16) to the measurement electrode (10), thereby enabling carbonaceous deposits to be adsorbed on the surface of the measurement electrode (10). In the subsequent titration phase, the heater sets the temperature of the solid state oxygen anion conductor (12) at or above the critical temperature, such that the conductor would conduct oxygen anions from the reference electrode (16) to the measurement electrode (10). The oxygen anions interact with the adsorbed carbonaceous deposits, and release them from the surface of the measurement electrode (10) in the form of carbon dioxide or other gaseous compounds. As a result, the electrical potential across the solid state oxygen anion conductor (12) would gradually revert back to its pre-adsorption equilibrium level. By measuring the current and time required for the electrical potential to completely revert back to the pre-adsorption equilibrium level, the amount of carbonaceous deposits can be derived there from.

B. Brosda does not teach or suggest “the heater sets a temperature of the solid state oxygen anion conductor below the critical temperature during an adsorption phase, and at or above the critical temperature during a titration phase.”

The objective of Brosda is to provide a gas sensor with which at least two gaseous components can be detected simultaneously. *See, col. 1, line 66 – col. 2, line 6.* The objective is obtained by constructing two separate measurement electrodes for different gaseous species on a solid state electrolyte sensor. *See, col. 2, lines 10-16.* One of the measurement electrodes is made of catalytically active material for measuring oxygen concentration, whereas the other measurement electrode is made of a catalytically

inactive material for detecting hydrocarbons. *See, col. 2, lines 58-67.* A voltage is applied across the solid state electrolyte to pump oxygen from the reference gas side to the measurement gas side, whereby an oxygen excess is formed on the measurement side, and a difference signal is measured between two different measurement electrodes. *See, col. 2, lines 24-31.* It is clear that Brosda measures hydrocarbons by deriving information from a differential signal between two measurement electrodes. This is different from measuring carbonaceous deposits by deriving information from two signals generated by the same measurement electrode in two different states, one adsorption phase and the other titration phase.

C. It would not have been obvious for a person skilled in the art to modify Brosda to include a heater that “sets a temperature of the solid state oxygen anion conductor below the critical temperature during an adsorption phase, and at or above the critical temperature during a titration phase.”

Brosda teaches away from the claimed limitation “the heater sets a temperature of the solid state oxygen anion conductor below the critical temperature during an adsorption phase, and at or above the critical temperature during a titration phase.”

Brosda states “if the gas sensor is used at temperature below 400°C, it is advantageous to provide the sensor with a heating element.” *See, col. 3, lines 51-53.* It is suggested that the high temperature is desirable because Brosda’s sensor needs the solid state electrolyte to be conductive all the time, in order to continuously pump oxygen from the reference electrode to the measurement electrode. Thus, it would not have been obvious for a person skilled in the art to set the temperature of the solid state electrolyte below and above the critical temperature in order to create the adsorption and titration phases,

alternately. The totality of the prior art must be considered, and proceeding contrary to accepted wisdom in the art is evidence of nonobviousness. *In re Hedges*, 783 F.2d 1038 (Fed. Cir. 1986). The fact that Brosda encourages the temperature to be higher than 400°C all the time, while the claimed invention requires the temperature alternating above and below the critical temperature is evidence of nonobviousness.

Claims 2, 6-9, 13, 14, 27, 28, 35, 37, 41 and 42

Claims 2, 6-9, 13, 14, 27, 28, 35, 37, 41 and 42 depend from independent claim 1 and include all the limitations recited therein. Accordingly, they are patentable over Brosda under 35 USC 102(b).

Rejections under 35 USC 103

Claims 3, 5, 10-12, 29-34, 36, 38-40, and 43-49 are rejected under 35 USC 103(a) as being unpatentable over Brosda in view of US Patent Application Publication No. 2003/0121801 to Inaba et al. (hereinafter referred to as “Inaba”) and US Patent No. 5,827,415 to Gur et al. (hereinafter referred to as “Gur”).

For the reasons discussed above, independent claim 1, as amended, is patentable over the cited prior art reference. Accordingly, claims 3, 5, 10-12, 29-34, 36, 38-40, and 43-49 that depend from claim 1 and include all the limitations recited therein are also patentable over Brosda, Inaba, and Gur under 35 USC 103.

CONCLUSION

Applicant has made an earnest attempt to place this application in an allowable form. In view of the foregoing remarks, it is respectfully submitted that the pending claims are drawn to a novel subject matter, patentably distinguishable over the prior art of record. Examiner is therefore, respectfully requested to reconsider and withdraw the outstanding rejections.

Should Examiner deem that any further clarification is desirable, Examiner is invited to telephone the undersigned at the below listed telephone number.

Applicant does not believe that any additional fee is due, but as a precaution, the Commissioner is hereby authorized to charge any additional fee to deposit account number 50-4244.

Respectfully submitted,

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